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(54) A method of assembling permanent magnet rotors for electrical machines

(57) A method of assembly includes locating a plurality of rare earth permanent magnet elements 11, by means of flats 12 and/or spacers 13, in equi-spaced relation on a magnetisable annulus 10. A non-magnetisable sleeve 14 surrounds the magnet elements 11 and is in captive engagement with axially-directed end faces of the annulus 10. A filler 15 ensures that all the volume between the annulus 10 and sleeve 14 is occupied.

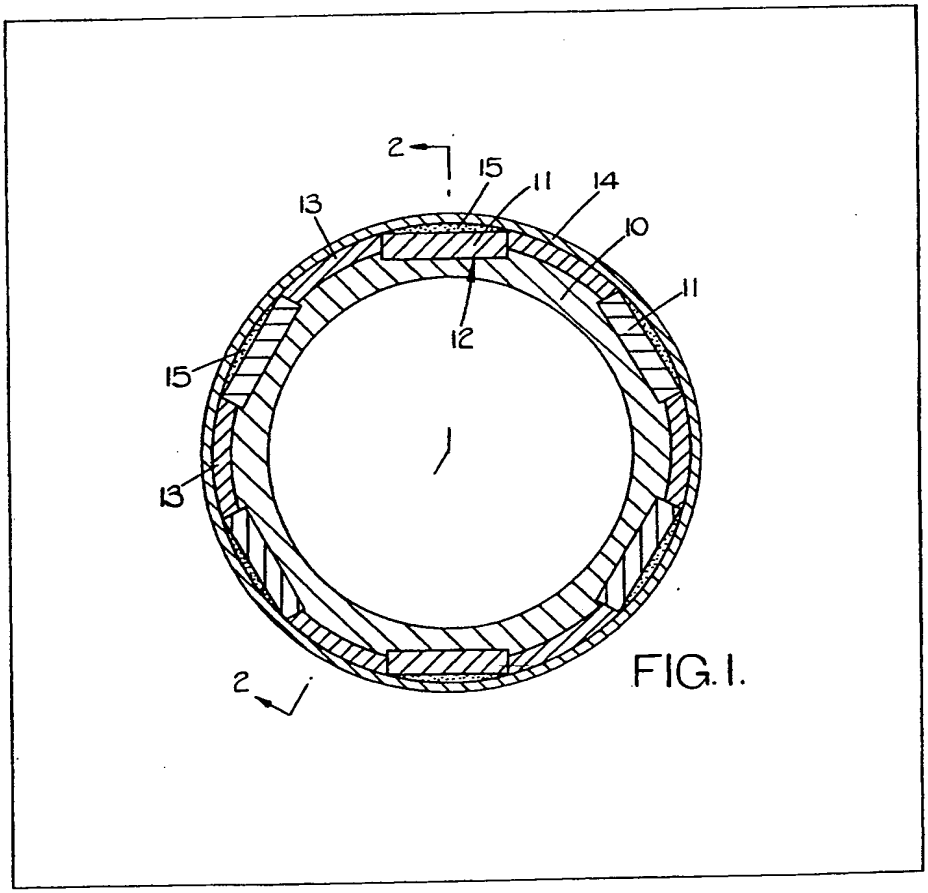

FIG.1.

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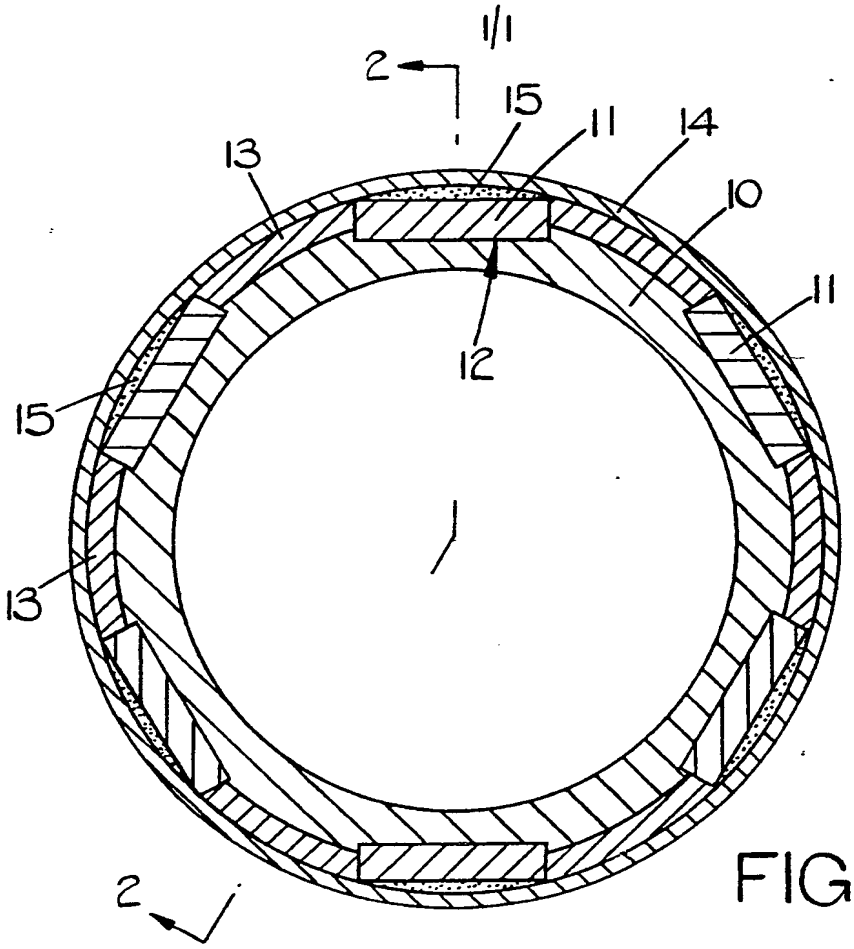

FIG. 1.

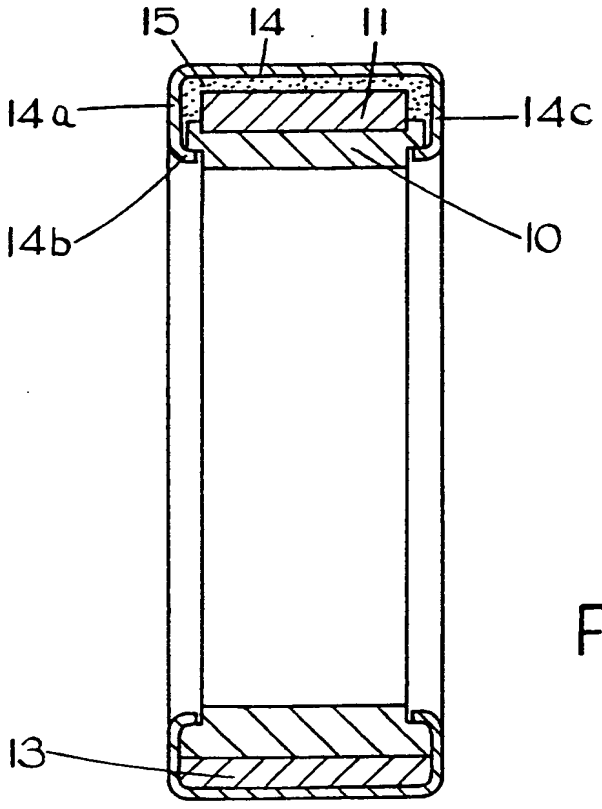

FIG. 2.

SPECIFICATION

Methods of assembling permanent magnet rotors for electrical machines

This invention relates to methods of assembling permanent magnet rotors for electrical machines.

It is known to provide rotary electrical machines having rotors of the kind in which a plurality of rare earth permanent magnets (for example of samarium cobalt) are secured to a rigid angular support. It has proved difficult to secure these permanent magnets to their annular supports so that they are adequately restrained against movement under the effects of centrifugal forces encountered in use, and in particular against the effects of centrifugal forces which are present in high speed machines.

Permanent magnet rotors of the foregoing kind have also been found to be susceptible to damage if the machine of which they form part are dismantled.

It is an object of the present invention to provide a methdd of assembling a permanent rotor of the foregoing kind, so that the resultant rotor is satisfactorily robust.

According to the invention a method of assembling a permanent magnet rotor for an electrical machine includes the steps of locating a plurality of permanent magnets in spaced relationship on the periphery of a rigid annular element, securing a sleeve to said annular element so as to engage the axially-directed end faces thereof such that said annular element and said sleeve substantially enclose said permanent magnets, and introducing a non-magnetisable filling into the spaces between said permanent magnets.

In one embodiment of said method said sleeve is first located with respect to one of said end faces, said filling is introduced into said spaces, and said sleeve is subsequently formed so as to be secured to both of said end faces.

In a particular embodiment said filling includes a plurality of non-magnetic rigid elements which serve to space said magnets around said periphery.

In a preferred embodiment said annular element is of a magnetisable material, and said sleeve is of a substantially non-magnetisable material.

The invention also resides in a permanent magnet rotor when produced by any of the methods above defined.

Embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings in which:-

Figure 1 is a transverse section through a permanent magnet rotor, and

Figure 2 is a second on line 2-2 in Figure 1.

As shown in the drawings a rigid annular element 10 of magnetisable material, for example soft iron, has a plurality of rare earth permanent magnet elements 11 located on its periphery in equi-spaced relationship. Location of the elements 11 may be by means of a plurality of flats 12 on the periphery of the element 10, and these flats 12 may, as shown, be slightly recessed.

Additionally, or alternatively, the elements 11 may be located around the priphery of the element 10 by non-magnetic spacers 13.

The elements 11, and spacers 13 where used, may temporarily be retained in their located positions on the element 10 by any suitable means, as for example by an elastic band. A sleeve 14 of non-magnetisable metal has an inner diameter such that it can surround the elements 11. The dimensions of the spacers 13, where used, are such that their outer surfaces closely engage the inner surface of the sleeve 14. An end 14a of the sleeve 14 is preformed as shown in Figure 2 so as to engage an axially-directed end face of the annular element 10 and includes an inturned lip 14b engaging an internal circumference of the element 10.

With the assembly resting on the end 14a of the sleeve 14, a suitable filler, indicated at 15, may then be run into the spaces remaining within the sleeve 14, after which the end 14c of the sleeve 14 is formed as shown in Figure 2 to engage the other axially-directed end face of the element 10, in a like manner to the end 14a, and thereby to render the sleeve 14 captive on the element 10.

The filler 15 may be of any suitable non-magnetisable material, and may be particulate or homogenous. In the latter case the filler 15 may be poured in in liquid form so as subsequently to cure or solidify with the sleeve 14. In a specific embodiment the filler 15 is an elastomeric material.

In alternative embodiments the filler 15 is of non-magnetisable metal, and may be of the same material as the spacers 13. The filler 15 and spacers 13 may in fact, be formed as a single unit, as for example by die-casting so as to locate and engage the permanent magnet elements 11. In this latter case the radial dimensions of the portions 13 are somewhat increased from those shown in Figure 1, to enable the parts 13, 15 to be formed integrally. In this last example, the sleeve 14 may, after its end 14a has been preformed, be heated before being passed over the parts 13, 15, and thereby subsequently to become a shrink fit on the remainder of the assembly. The end 14c of the sleeve 14 will, of course, subsequently be formed as shown in Figure 2.

In an alternative embodiment the sleeve 14 may be formed of a synthetic material such as fibreglass, the sleeve 14 being laid up to engage the filler 15, spacers 13 (where used) and the axially-directed end faces of the element 10.

The ends 14a, 14c of the sleeve 14 may be formed so as to be in sealing engagement with the element 10, in which case the filler 15 may be a liquid.

CLAIMS

1. A method of assembling a permanent magnet rotor for an electrical machine, including the steps of locating a plurality of permanent magnets in spaced relationship on the periphery of a rigid annular element, securing a sleeve to said annular element so as to engage the axially-directed end faces thereof such that said annular element and said sleeve substantially enclose said permanent magnets, and introducing a non-magnetisable filling into the spaces between said permanent magnets.

2. A method as claimed in Claim 1 in which said

sleeve is first loated with respect to one of said end faces, said filling is introduced into said spaces, and said sleeve is subsequently formed so as to be secured to both of said end faces.

3. A method as claimed Claim 1 or Claim 2 in which said filling includes a plurality of non-magnetic rigid elements which serve to space said magnets around said periphery.

4. A method as claimed in Claim 3 in which said filling additionally includes a solidifiable liquid material.

5. A method as claimed in Claim 4 in which said material is an elastometric material.

6. A method as claimed in Claim 1 in which said filling comprises a preformed unit in which said magnets are located.

7. A method as claimed in Claim 6 in which said sleeve is heated before assembly around said filling and said magnets, and is subsequently cooled to provide a shrink fit on said filling.

8. A permanent magnet rotor when assembled by the methods of any of Claims 1 to 7.

9. Methods of assembling a permanent magnet rotor substantially as hereinbefore described.

10. A permanent magnet rotor substantially as hereinbefore described with reference to the accompanying drawings.

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